# Space Weather Technical Forecast

Issued on Monday, 29 April 2024 at 00:09 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: A chance of further M-flares and slight chance of X-flares through the period.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Activity is currently Low, with several upper C-class flares originating from AR3654 during the period, the largest a C8.3 at 28/2020 UTC. There remain seven numbered sunspot regions on the visible disc. AR3654, west of centre disc, continues to dominate the flare risk. This region is showing further development in its intermediate/trailer portion in recent imagery and retains a delta spot configuration here. Remaining sunspot regions are all relatively small and stable, or showing slight decay. A new spot region is just beginning to emerge around the northeast limb, however an initial analysis is pending a fuller view.
No likely Earth directed CMEs were observed in available imagery.

**Solar Wind / Geomagnetic Activity:** Solar winds observed by ACE/DSCOVR at L1 have been variable but on an overall mostly steady trend, between 410-480km/s. Density has been mostly average. The Interplanetary Magnetic Field was weak, mainly 5-7 nT. The north-south component, Bz, also varied weakly -5/+6 nT. Phi angle was mostly positive (away from the Sun) with some brief negative (toward the Sun) periods. Geomagnetic activity was mainly Quiet (Kp 1 to 2), aside form an initial Active (Kp 4) interval 28/0000-0300 UTC.

**Energetic Particles / Solar Radiation:** High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence was well below the Active threshold, with a slight rising trend. Observed fluence at 29/0001UTC was 4.51e6 integrated pfu.

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** A chance of M-flares and a slight chance of X-flares is maintained though the period, this mainly in association with AR3654.

**Solar Wind / Geomagnetic Activity:** A CME which originated late on 26 Apr from an area of plage and a filament eruption in the southeast of the disc, could give a glancing blow early on day 2 (30 Apr).

Solar winds will likely continue at slightly elevated levels over the next couple of days, with further weak coronal hole influences from CH30/+ and CH29/+ possible, although these lie progressively further to the south. Later on day 3 (1 May) a more definite connection comes from coronal hole CH31/-, which should become geoffective.

Geomagnetic activity is expected to be largely Quiet at first, but with Unsettled periods developing on day 3 (1 May) as CH31/- becomes geoeffective. There is also a slight chance of isolated Active to G1/Minor Storm intervals on day 2 (30 Apr), should the possible glancing CME

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mentioned above materialise.

**Energetic Particles / Solar Radiation:** High energy proton flux is most likely to remain at background levels through this period. There is just a slight chance for an S1 or greater event, with AR3654 posing the main risk as it continues to rotate westwards. from the limb.
High energy electron flux could perhaps increase slightly toward the end of the period as HSS influences wane. However, fairly high confidence that fluence will remain well below the Active (1e8 integrated pfu) threshold.

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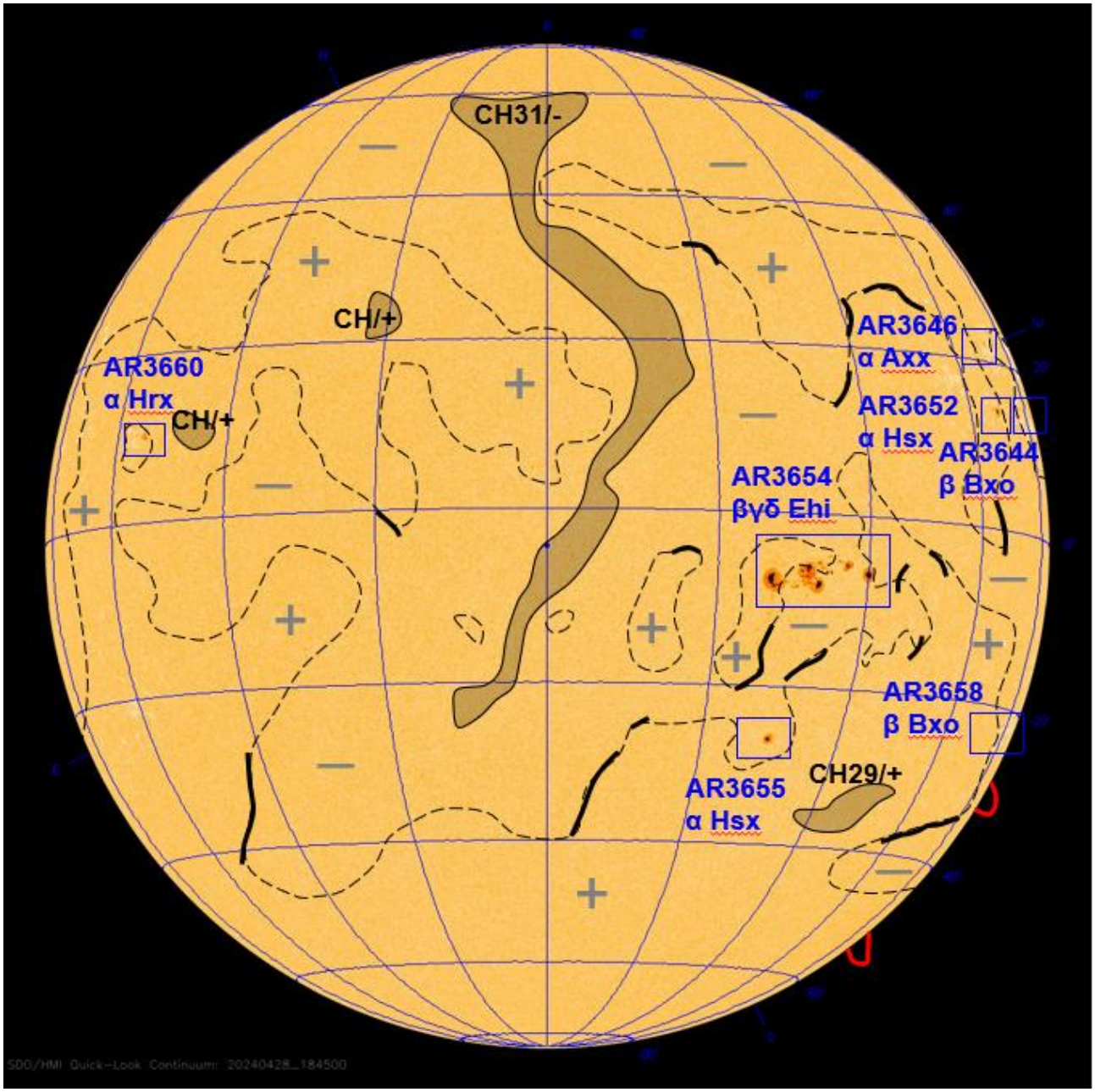
**Figure 1. Solar Analysis Valid 28/1900 UTC.**

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**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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# Met Office Space Weather Technical Forecast

## Geomagnetic Storms:

There is currently one CME potentially featuring in the forecast, this starting around 26/1830 UTC and emerged from an area of plage in the southeast of the disc, likely associated with a filament eruption. The resulting CME is modelled as mostly passing behind and below Earth's orbit, but there is a slight chance of a peripheral glancing blow on day 2 (30 Apr).

Solar winds have been at slightly elevated levels, and further weak coronal hole influences from CH30/+ and CH29/+ are possible in the next couple of days, although these lie progressively further to the south. Later on day 3 (1 May) a more definite connection comes from the narrow trans-equatorial coronal hole CH31/-, which should become geoffective. This is a recurrent feature which gave Unsettled geomagnetic conditions on the last rotation.

Geomagnetic activity is expected to be largely Quiet at first, but with Unsettled periods developing on day 3 (1 May) as CH31/- becomes geoeffective. There is also a slight chance of isolated Active to G1/Minor Storm intervals on day 2 (30 Apr), should the possible glancing CME mentioned above materialise.

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 1 | 10 | 5 | 5 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Geomagnetic Activity - Earthbound Coronal Mass Ejections

| Date/time 21.5R (UTC) | Halo: Full or Partial | Source | Source Location | Estimated Speed | Estimated Arrival Time | Comments |
|---|---|---|---|---|---|---|
| 27/0402 | Partial | Filament | SE | 472 km/s | 30/1200 UTC | Slight glancing blow possible |

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## Radio Blackouts - X-Ray Flares:

The large AR3654, located centre west of the visible disc, continues to dominate the flare risk and has been the source of the most recent M-class activity, along with several upper C-class flares in the past 24 hours. Further development in the intermediate/trailer portion of this region has been observed over the past 24 hours, and it retains a delta spot configuration here. Remaining sunspot regions are all relatively small and stable, or showing slight decay. A new spot region is just beginning to emerge around the northeast limb, however an initial analysis is pending a fuller view.

No significant returning regions are expected through the period with nothing currently signaled in far-side helioseismographs. The new spot region emerging at the northeast limb may balance the loss of regions in the west. Overall, a chance of further M-flares is maintained through the period, with a slight chance of isolated X-flares, this mainly from AR3654.

| X Ray Flares | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability | | | (%) | (%) | (%) | (%) |
| Active | R1-R2 M Class | No | 40 | 40 | 40 | 40 |
| Very Active | R3 to R5 X Class | No | 5 | 5 | 5 | 5 |

## Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. There is just a slight chance for an S1 or greater event, most likely from AR3654 as it continues to rotate westwards.

| Radiation Storms | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ S1 | No | 5 | 5 | 5 | 5 |
| Very Active | ≥ S3 * | No | 1 | 1 | 1 | 1 |

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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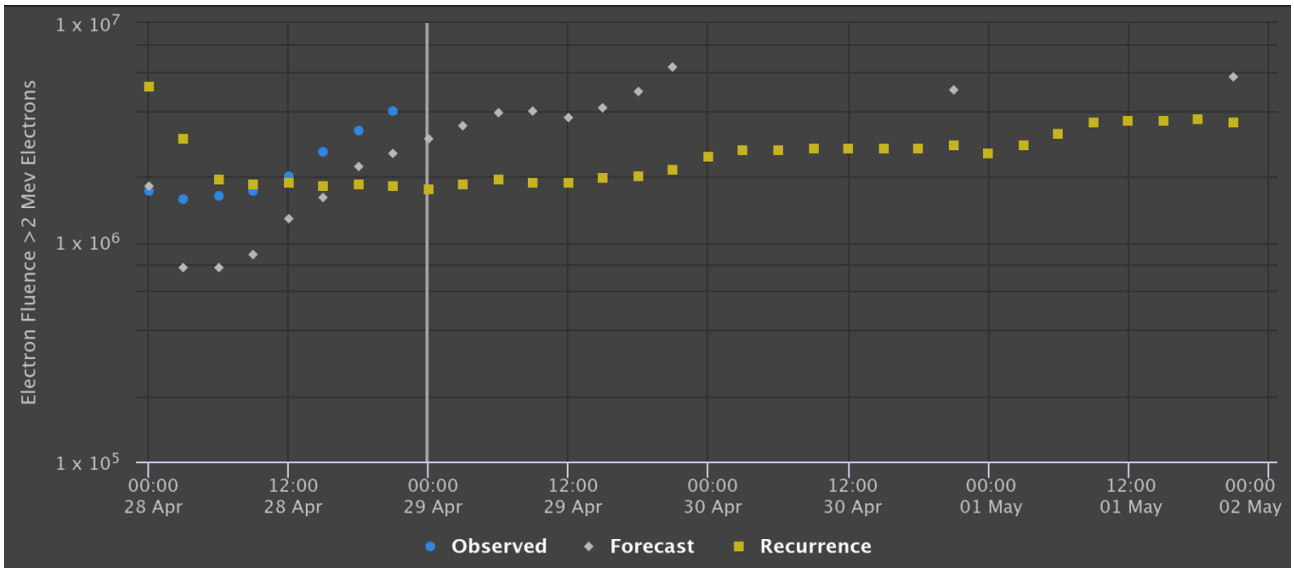
**High Energy Electrons Event (≥ 2MeV):**
High energy electron flux has been at background to moderate levels. There may be a slight rising trend in flux levels in the next couple of days, with any potential small coronal hole influences expected to be weak. However, later on day 3 (1 May) CH31/- is likely to become geoeffective, and there is also a low chance of a peripheral CME glance on day 2 (30 Apr). Either of these features would tend to reduce electron counts if we saw any significant geomagnetic enhancement.

The 24 hour integrated electron fluence is most likely to remain well below the Active (1e8 integrated pfu) threshold, but perhaps with a slight rising trend at the end of the period, if the anticipated HSS from CH31/- begins to wane by this time. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

| GEO Electron Environment | Level ($cm^{-2}\ sr^{-1}\ day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ 2 MeV ≥ $1x10^8$ | No | 1 | 1 | 1 | 5 |
| Very Active | ≥ 2 MeV ≥ $1x10^9$ | No | 1 | 1 | 1 | 1 |

**Figure 2: Latest MOSWOC REFM output**

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